EP0864458 - Device for controlling the supply of fuel to a combustion engine

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Description OF EP0864458

State of the art

The invention concerns a device for the fuel system of an internal-combustion engine of a motor vehicle in the generic term of the requirement 1 defined kind.

With by the DE 39 15 185 c1 device of this kind with as to so-called saddle tank trained fuel tanks is in everyone of the two provision with stocks chambers formed of a saddling ash a saugstrahlpumpe or a jet pump, consisting of an injector nozzle and an injector funnel, admitted near the tank bottom arranged. The return pipe flowing in the fuel tank is attached over a distributor area to the two jet pumps. At the injector funnel of the first jet pump in the first provision with stocks chamber in the second provision with stocks chamber flowing a first supply line is and at the injector funnel of the second jet pump in the second provision with stocks chamber is a second supply line flowing in the withdrawal chamber attach-attaching these withdrawal chamber is fastened within the second provision with stocks chamber on the tank bottom and takes up the fuel pump. With enterprise of the internal-combustion engine the fuel return stream divides itself on the two jet pumps. The fuel pump is laid out in such a way with the fact that the return quantity necessary for the supply of both jet pumps is sufficient also still with maximum fuel consumption of the internal-combustion engine.

With internal-combustion engines with extremely high full load consumption however the return quantity is small for the supply of both jet pumps too, so that the function is into a no more ensured to provision with stocks chamber the withdrawal chamber filling jet pump. One here usually creates remedy by connecting a second fuel pump.

With further, by the DE 42 24 981 A1 these admitted fuel conveyer system the fuel from a provision with stocks chamber into the withdrawal chamber umpumpende jet pump with a fuel stream are operated, which branched over a branch line of the pressure line near the exit of the fuel pump. In order to guarantee a reliably rapid starting of the internal-combustion engine, a non-return valve is arranged in the branch line before the jet pump, which opens only with exceeding

of a certain border pressure in the branch line. Thus escaping of fuel, disturbing during the starting phase, is avoided over the branch line and the jet pump.

According to invention fuel system device for internal-combustion engine by marking characteristics requirement 1 has advantage that by the disconnection at least one jet pump for the duration of of the high fuel consumption of the internal-combustion engine, which is sufficient by the fuel pipe flowing amount of fuel, which is strongly reduced by the high fuel consumption, now, to ensure the function at least the withdrawal chamber filling jet pump during the given mechanical handling capacity of the fuel pump. In border lines can be done thereby without an additional fuel pump.

The maximum delivery need, for which the fuel pump must be laid out, is reduced by the employment according to invention of the closing or throttle valve by the amount of fuel necessary for the enterprise of the disconnectible jet pump. This from the fuel pump to delivery need which can be ensured sits down together from the maximum fuel consumption of the internal-combustion engine as well as the amount of fuel necessary for the unimpaired enterprise of all jet pumps. With maximum fuel consumption of the internal-combustion engine at least if one jet pump is temporarily switched off according to invention, then the maximum delivery need reduces by the driving quantity of this jet pump. Thus the capacity and the operating noise of the fuel pump are reduced and increased their life span.

By the measures specified in the further requirements favourable training further and improvements of the device indicated in the requirement 1 are possible.

In accordance with a favourable execution form of the invention the valve of the amount of fuel flowing through the valve steered. The flow rate-steered valve has the advantage of the direct control by the amount of fuel flowing affected directly by the fuel consumption by the fuel pipe, so that suitable steuergroessen for the valve do not only have to be derived from the fuel consumption and be transformed e.g. into electrical control signals.

In accordance with a preferential execution form of the invention such a flow rate-steered valve is realized thereby that the valve with one another receives at least three valve connections standing over a valve chamber in connection, by which first with the fuel pipe and a further with one the Umpumpvorrichtungen in each case is connected, and at least one of the valve connections connected with the Umpumpvorrichtungen is up-steered proportionally to the amount of fuel flowing in over the first valve connection. Valve geometry is laid out preferentially in such a way that a Aufsteuern of this valve connection uses another valve connection only with exceeding over flowing minimum amount of fuel, which is necessary for the enterprise of the Umpumpvorrichtung attached to it.

Design

The invention is more near described on the basis remark examples represented in the design in the following description. Show in each case in schematic representation:

Fig. 1 an internal-combustion engine with a device for fuel system,
Fig. 2 to 4 in each case a profile of a valve of the device in accordance with Fig. 1 in three different switching positions,
Fig. 5 a same representation as in Fig. 2 of a modified valve,
Fig. 6 an internal-combustion engine with a device for fuel system in accordance with a modified execution

Description of the remark examples

In Fig. 1 is suggested with 10 an internal-combustion engine, whose fuel need is covered by a supplying device. The fuel system device covers a fuel tank 11 and a fuel pump 12, the fuel from the fuel tank 11, arranged in the fuel tank 11, sucks in and over a pressure line 13 to the internal-combustion engine 10 promotes. Surplus, fuel used up in the internal-combustion engine 10 flows back over a return pipe 14 into the fuel tank 11. The return pipe 14 can exhaust also from a not represented pressure control valve, by which the pressure in the injecting mechanism of the internal-combustion engine in a given height is regulated. The pressure control valve can be thereby at or in the fuel tank arranged or far away from this.

The fuel tank 11 is implemented as so-called saddle tank, which is in such a manner conceived that it can be installed for example under the fondsitz of a passenger car. For this purpose the middle range of the fuel tank 11 forms a tunnel 15 to would drive through for a drive shaft for a rear-axle drive. This tunnel divides the fuel tank 11 according to kind of saddling ashes into two provision with stocks chambers 16.17, which are connected by a bypass area 18. The fuel tank 11 is filled over a filler neck 19, which is final of a gas cap 20. The fuel pump 12 is in a withdrawal chamber 21, which abstrebenden within the provision with stocks chamber 17 by means of one of the tank bottom vertically partition 22 are separated, integriert.In each provision with stocks chamber 16.17 is arranged a Umpumpvorrichtung in form of a saugstrahlpumpe or a jet pump 23.24, whereby the jet pump serves 23 for the Umpumpen of fuel from the provision with stocks chamber 16 in the provision with stocks chamber 17 and the jet pump 24 for the Umpumpen of fuel from the provision with stocks chamber 17 into the withdrawal chamber 21. Each jet pump 23.24 working after the venturi principle consists in well-known way of an injector nozzle 25 and an injector funnel 26. The injector funnels 26 open to the provision with stocks chamber 16 is at a connecting tube 27 and the injector funnels 26 of the jet pump 24 flowing in the provision with stocks chamber 17 open to the provision with stocks chamber 17 is finallateral finallaterally at a connecting tube flowing in the withdrawal chamber 21 28 attach-attaching those both injector nozzles 25 of the jet pumps 23.24 stand over a valve with the return pipe 14 in connection, so that in well-known way by each fuel stream from the respective provision with stocks chamber 16.17, flowing through the injector nozzles 25 of the jet pumps 23.24, fuel is drug along over the injector funnel 26 and over the connecting tubes 27.28 into the provision with stocks chamber 17 and/or into the withdrawal chamber 21 arrives. Both jet pumps 23.24 guarantee that withdrawal chamber 21, from which fuel pump 12 fuel sucks in, always filled is and of fuel pump 12 only then emptied, if the fuel in the provision with stocks chambers ensures 16.17 used up be-being that between the return pipe 14 and the two jet pumps 23.24 existing valve 30 for the fact that with very high fuel consumption of the internal-combustion engine 10 temporarily the jet pump 23 is switched off, so that over the return pipe the 14 into the fuel tank 11 back-flowing, strongly reduced amount of fuel is sufficient at least, the unimpaired enterprise of the jet pump 24 in the provision with stocks chamber 17 for filling the withdrawal chamber 21 to keep upright. As soon as the fuel consumption of the internal-combustion engine sinks again and over the return pipe the 14 into the fuel tank 11 back-flowing surplus fuel increases again quantitatively, the valve 30 releases also the connection of the return pipe 14 to the jet pump 23 again, so that both jet pumps 23.24 work again.

The structure of the valve 30 is in detail in the sectional views of the Fig. to see 2 to 4. The valve 30 exhibits a valve body 31, in which a valve chamber 32 is trained. In the valve chamber 32 three 31 valve connections 33 to 35 with pipe unions, inserted into the valve body, flow. The first valve connection 33 serves the return pipe 14, which is second valve connection 34 for attaching a feeder line 36 and the third valve connection 35 leading to the injector nozzle 25 of the jet pump 23 for attaching a feeder line 37.An of the delta of the valve connection 34 in the valve chamber 32 leading to the injector nozzle 25 of the jet pump 24 a ventiloeffnung 39 umschlossene of a valve seat 38 trained for attaching, which is steered by a valve member 40 cooperating with the valve seat 38 as a function of the valve chamber 32 flowing through fuel return quantity. Valve geometry is in such a way arranged that the ventiloeffnung 39 is up-steered proportionally to the

amount of fuel flowing in over the first valve connection 33 into the valve 30 and the Aufsteuern of the ventiloeffnung 39 takes place only with exceeding of a minimum amount of fuel, which is necessary for the enterprise of the jet pump 24 flowing off over the valve connection 35.

In detail the valve member 40 relocatable enclosed in the valve chamber 32 is subjected to a valve recoil spring 41 designed as screwing jerk feather/spring in valve closing direction, which presses the valve member 40 with a seal body einstueckig trained to it 401 on the valve seat 38. At the valve member 40 circularly a control surface 402 is trained around the seal body 401, which is subjected to the fuel flowing in over the first valve connection 33. The fuel pressure on the control surface 402 works against the closing force of the valve recoil spring 41, so that during sufficient application of pressure the valve member 40 in Fig. 2 and the seal body 401 is shifted to the left increasingly by the valve seat 38 abhebt.Im valve member 40 is brought in a drosselbohrung 42, over which the valve connection 33 with the valve connection 35 connected with the jet pump 24 stands in constant connection.

The impact of the valve 30 is as follows:

Fig. the valve shows 2 in its basic position. The ventiloeffnung 39 is closed of the valve member 40 under the effect of the reset spring 41. Over the return pipe the 14 and the first valve connection 33 32 fuel return quantity flowing in into the valve chamber flows over the drosselbohrung 42 for the valve connection 35 and from there over the feeder line 37 to the jet pump 24 in the second provision with stocks chamber 17. The return quantity is sufficient by interpretation large, in order to maintain the enterprise of the jet pump 24, so that the withdrawal chamber 21 by Umpumpen by fuel from the provision with stocks chamber 17 is kept constantly filled with fuel.

Now if the fuel return quantity increases due to smaller consumption of the internal-combustion engine, then the decrease of pressure rises over the drosselbohrung 42, until the hydraulic strength given by decrease of pressure and valve geometry is larger on the valve member 40 than the pre-loading of the valve recoil spring 41 and the seal body take 401 straight from the valve seat 38 off. This condition is in Fig. 3 illustrates. As already already suggested it is the spring action of the valve recoil spring 41 and valve geometry are in such a way laid out that now the fuel return quantity flowing in over the first valve connection, which exceeds 24 necessary minimum driving quantity for the enterprise of the jet pump. If the fuel return quantity continues to rise now, then this multi-quantity becomes first at the valve seat 38 redirect-redirecting that valve member 40 stands out only easily against the valve seat 38 and releases straight so much cross section that the multi-quantity can divert and the decrease of pressure remains quasi constant over the throttle 42. The multi-quantity diverts 34 to the jet pump 23 in the provision with stocks chamber 18 over the second valve connection. As long as this multi-quantity is smaller than to the enterprise the jet pump 23 necessary driving quantity is functional the jet pump 23 not yet. If the redirected multi-quantity achieves now for the function of the jet pump 23 necessary minimum driving quantity, then also the appropriate driving pressure develops itself before the jet pump 23. This driving pressure practices now over the seat face of the seal body 401 an additional strength on the valve member 40 out made of valve geometry is in such a way laid out the fact that the whole forces of the affecting the valve member 40 is sufficient now, in order to take this off from the valve seat 38, i.e. opens the valve 30 completely, as soon as over the valve connection 33 the entire fuel return quantity flowing in is more largely or equal the sum of the minimum driving quantities for the two jet pumps 23.24 (Fig. 4).

In Fig. 5 represented modified valve 30' is opposite the described valve 30 to that extent modified, when the valve member 40' is designed as ball, which is pressed by the valve recoil spring 41 on the valve seat 38. The connection between the valve connection 33 and the valve connection 36, those with the valve in accordance with Fig. 2 by the drosselbohrung 42 one manufactures, is here realized by a throttle gap 43 between the spherical valve member 40' and the inner wall of the valve chamber 32. In all other respects structure and function mode of the modified valve are 30' in accordance with Fig. 5 identically to to Fig. 2 described valve 30, so that one refers on that.

The invention is not limited to that managing described remark example. So that knows the fuel return stream to the jet pump 23 as a function of the fuel consumption of the internal-combustion engine 10 throttling or closing valve 30 and/or. 30' instead of of the fuel return quantity flowing through the valve also by the pressure in the fuel return pipe 14 to be steered. Likewise it is possible to plan an electromagnetically steered valve whose control signal is derived from the measured fuel consumption of the internal-combustion engine.

In figure 6 a modified execution of the device is represented for the fuel system of the internal-combustion engine 10, with of the print page the feed pump 12, for example of the pressure line 13, a fuel pipe 50 branches. The injector nozzles 25 of the jet pumps 23.24 stand over the valve 30 and/or. 30' with the fuel pipe 50 in connection, by which a part of the amount of fuel promoted by the feed pump 12 flows and into the fuel tank 11 arrived. The return pipe 14 can be nevertheless intended thereby, however by these the jet pumps 23.24 are not fed. The training of the valve and its impact are described thereby directly as managing.

The number of provision with stocks chambers in a fuel tank 11 can be arbitrary, whereby with several provision with stocks chambers in the fuel tank with jet pump, integrated from each other separated, in each case several jet pumps can be shut down also at the same time. It is important that the jet pump steered from the valve 30 is not always that, which in the long run the withdrawal chamber 21 with fuel filled so that with maximum fuel consumption of the internal-combustion engine for sufficient fuel supply in the withdrawal chamber 21 is provided always.

Claims OF EP0964158

1. Device for the fuel system of an internal-combustion engine with one at least two provision with stocks chambers (16,17) and a withdrawal chamber (21) exhibiting fuel tank (11), with one suction-side with the withdrawal chamber (21) and pressure-laterally with a pressure line (13) connected fuel pump (12), leading to the internal-combustion engine (10), with a fuel pipe (14;50), flowing in the fuel tank (11), by which a part of the fuel promoted by the fuel pump (12) arrived into the fuel tank (11), and also in in each case one of the provision with stocks chambers (16,17) arranged, fuel stream flowing from by the fuel pipe (14;;50) propelled Umpumpvorrichtungen, in particular jet pumps (23,24), to the Umpumpen of fuel from the provision with stocks chamber (16,17) into the other provision with stocks chamber (17) or into the withdrawal chamber (21), characterized by a valve (30;30 '), which throttles or closes one zumindestens a Umpumpvorrichtung (23) flowing component current of the fuel stream as a function of the fuel consumption of the internal-combustion engine, flowing by the fuel pipe (14;50).

2. Device according to requirement 1, by the fact characterized that the valve (30;30 ') of that the valve (30; 30') flowing through amount of fuel steered.

3. Vorrichtung according to requirement 2, by it characterized that the valve (30;30 ') with one another exhibits at least three valve connections (33,34,35), standing over a valve chamber (32) in connection, of which a first valve connection (33) by the fuel pipe (14;50) and in each case a further (34,35) with a Umpumpvorrichtung (23,24) is connected, and that at least one of the valve connections (34,35), connected with the Umpumpvorrichtungen (23,24), is an openable as a function of the amount of fuel flowing in over the first valve connection (33).

4. Vorrichtung according to requirement 3, by the fact characterized that valve geometry is so laid out that a Aufsteuern of the valve connection (34) begins only with exceeding of a minimum amount of fuel, which is necessary for the enterprise of the Umpumpvorrichtung attached to it (24) flowing over another valve connection (35).

5. Vorrichtung according to requirement 3 or 4, by the fact characterized that between the valve chamber (32) and the steered valve connection (34) a ventilöffnung (39) with valve seat (38) is trained that the valve seat (38) a valve member (40;40 ') under the strength of a valve recoil spring (41) rests upon, locking the ventilöffnung (39), and that the valve member (40;40 ') a control surface subjected to the fuel in valve opening direction, flowing in over the first valve connection (33), (402) as well as a drosselbohrung exhibits (42), which a permanent connection between the first valve connection (33) and the uncontrolled valve connection (35) for a Umpumpvorrichtung (24) manufactures.

6. Device according to requirement 5, by the fact characterized that the uncontrolled valve connection (35) is connected with the withdrawal chamber (21) filling Umpumpvorrichtung (24).

7. Device according to requirement 1, by the fact characterized that the valve (30) of the pressure in the fuel pipe (14;50) steered.

8. Device according to requirement 1, by the fact characterized that the valve (30) steered electromagnetically.